

## CLAIMS

What is claimed is:

Sub  
a1  
5

1. A method for forming hardened semiconductor interconnects comprising:  
depositing a metal layer on a semiconductor wafer surface;  
introducing additional metal species into said metal layer; and  
performing chemical-mechanical polishing of said deposited metal layer  
wherein said additional metal species hardens said deposited metal layer to  
reduce the rate of said polishing.

005125.122600  
D1  
10

2. The method of claim 1, wherein said deposited metal layer is copper.

3. The method of claim 2, wherein said additional metal species is beryllium.

15

4. The method of claim 3, wherein the beryllium forms a solid solution in  
said deposited copper layer.

Sub  
a2  
20

5. A method for forming hardened semiconductor interconnects comprising:  
depositing metal layers on a semiconductor wafer surface;  
introducing additional metal species;  
heating the deposited metal film with the introduced metal species;

allowing the heated metal film to cool, so as to form precipitates of said introduced metal species; and

performing chemical-mechanical polishing wherein said additional metal precipitate hardens said deposited metal layer to reduce the rate of said polishing.

6. The method of claim 5, wherein the deposited metal layer is copper.

7. The method of claim 5, wherein the additional metal species is beryllium.

8. A method for forming hardened semiconductor interconnects comprising:  
depositing metal layers on a semiconductor wafer surface;  
introducing additional metal species;  
heating the deposited metal film with said introduced metal species in an oxidizing atmosphere to oxidize said additional metal species; and  
performing chemical-mechanical polishing wherein said oxidized additional metal species hardens said deposited metal layer to reduce the rate of said polishing.

9. The method of claim 8, wherein said deposited metal layer is copper.

10. The method of claim 8, wherein the additional metal species is aluminum.

11. The method of claim 10, where the oxidized aluminum in the copper layer forms oxide dispersion-strengthened copper.

5 12. A method for hardening semiconductor device interconnects comprising:  
fabricating an oxide-dispersion hardened metal sputtering target; and  
sputtering said oxide-dispersion hardened metal directly onto the  
semiconductor dielectric layer.

10 13. The method of claim 12, wherein the deposited oxide-dispersion hardened metal layer is copper with an aluminum oxide solute.

14. A semiconductor device, comprising:  
a silicon substrate;  
15 at least one dielectric layer deposited on said substrate;  
trenches etched through said dielectric layer, so as to allow connection of a  
second layer to the silicon substrate below;  
at least one metal layer deposited on top of said dielectric layer, with said  
metal filling said trenches in said dielectric layer;  
20 a second metal dispersed throughout said metal layer, the combination  
thereof forming a layer of metal of differing hardness than the pure metal; and  
a second layer of dielectric over said contiguous metal layer.

15. The metal layer of claim 14, wherein said metal layer is dispersion-hardened.

5 16. The metal layer of claim 14, wherein said metal layer is precipitation-hardened.

17. The metal layer of claim 14, wherein said metal layer is oxide-dispersion hardened.

Added  
A3 7

00622T 5T25Z60